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## II. Operation

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This chapter explains the procedure for setting up and initiating safe and effective operation of the **Belmont F MS2000**.

**WARNING!**

Do not use this product in the presence of flammable anesthetics.

**WARNING!**

Do not use with pressure infusers or “bag squeezers”. The system pump provides adequate pressure to infuse fluid.

**WARNING!**

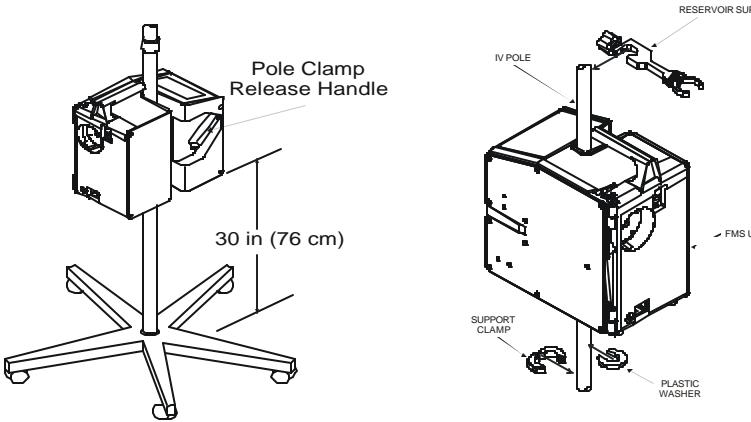
The Belmont *F MS2000* is not for use in warming platelets, cryoprecipitates, or granulocyte suspensions.

**WARNING!**

The *F MS2000* is intended for infusion of high volume warm replacement fluid or blood component. It is not intended for drug administration.

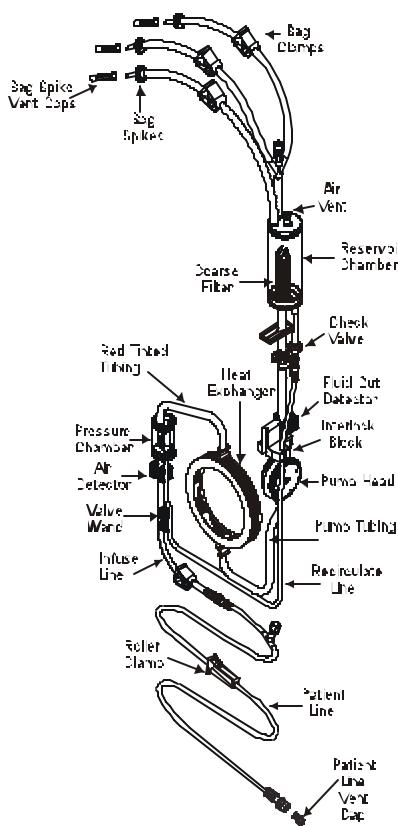
### STEP-BY-STEP SUMMARY OF OPERATING PROCEDURES

The following is a step-by-step summary of the major steps; the remainder of the chapter explain each step in detail.

SET-UP	
<b>INSPECT THE SYSTEM</b> <ul style="list-style-type: none"> <li>• Power cord</li> <li>• Reservoir Support</li> <li>• Disposable Set</li> <li>• Large Reservoir and holder, if needed</li> </ul>	<p>Inspect the system to ensure that you have all necessary components.</p> <p>Use only supplied power cord.</p>
<b>IV POLE MOUNTING</b> <ul style="list-style-type: none"> <li>• IV Pole: 5 wheel, maximum diameter 1 1/4"</li> <li>• Install the Support Assembly 30" above the IV pole base</li> <li>• Mount the F MS2000 on the IV Pole above the Support Assembly</li> <li>• Install the Reservoir Support app. 9" above the top of the system</li> </ul> <p><b>CAUTION:</b> Check that the system is securely clamped to an IV pole and will not tip over</p>	 <ol style="list-style-type: none"> <li>1. Install the support assembly (support clamp and washer) approximately 30" from IV pole base. <ul style="list-style-type: none"> <li>• While holding clamp closed, loosen the screw to open up the clamp. Install clamp on the IV pole, holding clamp close and tighten screw using supplied 3/16 allen wrench.</li> <li>• Snap the plastic washer onto the IV pole above the support clamp.</li> </ul> </li> <li>2. Lift up on the "Pole Clamp Release Handle" to open. Mount the system onto the IV pole, above the support assembly, by pushing down on the pole clamp release handle. Check that the system is locked in place before proceeding.</li> <li>3. Clamp the reservoir support onto the IV pole approximately 9" above the F MS2000. <ul style="list-style-type: none"> <li>• Make certain that there is nothing obstructing the air vents at the bottom of the system.</li> </ul> </li> </ol>

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### INSTALLING DISPOSABLE SET



3-Spike Disposable set with key components

#### WARNING:

The disposable set is for single patient use only. Do not reuse.

Store the disposable set in a dry well-ventilated area free from exposure to chemical vapors. Always apply first-in, first-out technique to minimize the length of storage for any unit.

1. Snap reservoir chamber into the reservoir support clamp.



2. Open the door. Insert heat exchanger with red arrow pointing up (Red tinted tubing to red stripe on unit.)



3. Firmly position the interlock into the fluid out detector.

4. Guide the curved piece of pump tubing (Blue tinted tubing) over the pump head. Check that the thinner recirculate line is in the groove to the right.

**Do not kink or twist the tubing**



5. Place the pressure chamber into the pressure chamber well. Firmly insert the wider infuse line into the air detector and to the left of valve wand.

**Do not apply excessive pressure to the pressure transducer. The pressure transducer can be damaged with excessive force. Do not use the system if the pressure transducer is damaged.**

6. Place the thinner recirculate line to the right of the air detector, and to the right of the valve wand.

7. Close and latch the door. Make certain the pump tubing is not caught. Connect the patient line.

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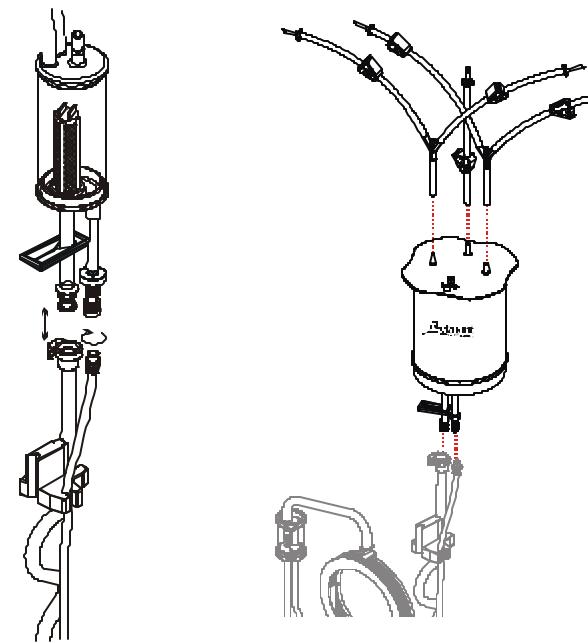
### INSTALL LARGE RESERVOIR, IF NEEDED

- Install large reservoir holder
- Install large reservoir



#### CAUTION:

**Do not pressurize or apply a vacuum to the reservoir**



1. Using aseptic techniques, remove the reservoir chamber from the 3-Spike disposable set by disconnecting the luer connectors.
  - Disconnect the larger pump tubing by pressing in the luer lock tab and pulling out the connector.
  - Disconnect the thinner recirculate line by unscrewing the connector.
2. Attach the reservoir holder onto the IV pole and place the reservoir into the holder.
3. Assemble the large reservoir using aseptic techniques by attaching the three fluid supply tails onto the top of the reservoir.
4. Connect the large reservoir to the luer of the 3-Spike disposable set.
5. Adjust the reservoir holder to make sure that the two connection leads underneath the reservoir are not stretched or kinked.

Stretched or kinked connection leads can cause flow restrictions and frequent Fluid Out alarms.
6. Install the 3-Spike disposable set into the F MS2000, as previously shown.

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### POWER ON

- Check that the detachable power cable is securely seated in the main power receptacle.
- Plug the system power cord into a grounded, 3-prong, 20 Amp, AC receptacle. Do not use an adaptor for ungrounded outlets.

1. Turn power on by firmly pressing the circuit breaker to the ON position. The system will perform a self-check to check the integrity of system parameters.
2. AC POWER PRESENT appears at the logo screen when the system first powers up. Check the power cord and AC receptacle connections if the statement does not appear.
3. PRIME screen will appear.
4. If you turn power ON without the disposable set, MISSING DISPOSABLE message and alarm will appear.
5. Open the door or press MUTE to silence the alarm then install the disposable set as described earlier.
6. Press NEXT to go to the PRIME screen.

### INSTALLING FLUID BAG

**Install solution compatible with blood for the main system prime.**

1. Hang fluid bag on the IV pole.
2. Close bag clamps, remove the bag spike cap(s). Spike fluid bag(s), pierce it fully to ensure that fluids flow freely.
3. Open bag clamps.

When hanging the fluid bag above the machine, the pump tubing that is seated in the fluid out detector should not be stretched. Stretching the pump tubing may cause false Fluid Out alarms.

The recirculate line must not be kinked or restricted.

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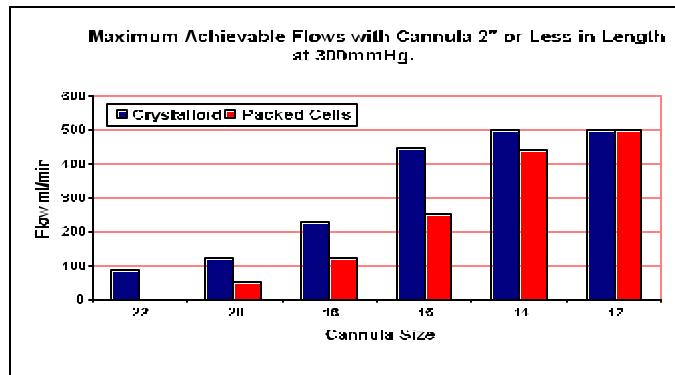
<b>PRIME THE MAIN SYSTEM</b>  <b>Prime the main system with solution compatible with blood. Do not prime with blood.</b>	<ol style="list-style-type: none"><li>1. Press PRIME to recirculate 100 ml of fluid at 500 ml/min to remove air and replace the main system with fluid.</li><li>2. The prime volume, 100 ml, countdown is displayed on the screen. Stop automatically when countdown reaches 0 ml.</li><li>3. If after 30 seconds and the prime volume remains at 100 ml, the system will stop, alarm and instruct the user to unclamp the lines and resume prime.</li><li>4. If prime has to be stopped, press STOP. The prime volume countdown will remain on the screen. Press RESUME PRIME to continue prime.</li></ol>
<b>PRIME THE PATIENT LINE</b>  To remove air from the patient line.  <b>WARNING!</b>  <b>Before continuing, you must inspect and make certain that the patient line is completely primed and free of air. Any air bubbles after the diversion valve in the patient line must be removed before the procedure can safely continued.</b>	<ol style="list-style-type: none"><li>1. Open the roller clamp and remove the luer cap.</li><li>2. Press PT. LINE PRIME Press once, prime at 50 ml/min. Press and hold, prime at 200 ml/min.</li><li>3. Press STOP after no air in patient line. Inspect to make sure that no air in the patient line. If there are air bubbles after the diversion valve, press PT. LINE PRIME to remove air.</li></ol>

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### CONNECT TO THE PATIENT

Match infusion set to flow rate and fluid type, see chart.

1. Select an appropriate cannula size for decided flow rate.



2. Using aseptic technique, make patient connection without entrapping air.

### INITIATING INFUSION

#### WARNING:

**Do not mix lactated Ringer's or other solution containing calcium with citrated blood products**

**Use only anticoagulated blood products**

1. Press INFUSE to start infusing at 10 ml/min.
2. Press 500 ML/MIN key to infuse at 500 ml/min or adjust flow rate, as needed, by pressing INFUSE RATE ▲/INFUSE RATE ▼ key.

There is no heat at 2.5 and 5.0 ml/min settings. Message 'LOW FLOW, NO HEAT' flashing on the screen indicates that the system is not heating at low flow rates.

## II. Operation

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### MAINTAIN INFUSION

#### CAUTION:

**Replace reservoir chamber or disposable set every 4 hours or less when blood products are used to limit bacterial growth and maintain proper flow.**

Routinely check patient and system parameters, on screen. Respond to and correct system alarms.

"The filter traps cells, cellular debris, and coagulated protein, resulting in a high protein concentration at the filter surface", AABB 13<sup>th</sup> Edition\*.

\* American Association of Blood Banks, Technical Manual 13<sup>th</sup> Edition

#### ► Pressure Control

Regulate the pump speed to keep line pressure under the user-set pressure limit

The pressure status line flashes and a periodic beep sounds while the system is under pressure control. Line pressure is mainly due to the small orifice of the infusion set or any occlusions in the line.

The pressure limit is set at the factory to the maximum limit of 300 mmHg. To reduce the limit, see Chapter IV, Parameters Set-Up.

#### ► Automatic Air Purging

Remove air from the main system

After every 500 ml of fluid infused, the system automatically purges air from the system.

The RATE status line displays REMOVING AIR during this process. The volume readout (VOL) remains unchanged during automatic air purging and resumes counting when infusion resumes.

The recirculate rate is temporarily set to 500 ml/min during automatic air purging, if the flow rate is at or below 500 ml/min. The recirculate rate is at the actual flow rate, if the flow rate is above 500 ml/min. When infusion resumes, the system returns to the previously set rate.

#### ► Bolus

Deliver fixed volume at a rate of 200 ml/min

The bolus volume is set at the factory to 200 ml. This can be changed in the Parameters Set-Up screen (see Chapter IV) or by pressing and holding the BOLUS key in the Infuse screen. The new bolus volume will appear in the VOL (volume) status line with the prefix of BOL (bolus). Releasing the Bolus key will start the infusion.

To change the flow rate during the bolus infusion, press the INFUSE RATE ▲ or INFUSE RATE ▼ or 500 ml/min RATE key.

At the end of the bolus volume, the system beeps and returns to the previously selected flow rate if the previous rate was 50 ml/min or lower. If the previous rate was higher than 50 ml/min, the flow rate will be set to 50 ml/min.

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### BATTERY OPERATION (NO HEAT)

1. Press RECIRC key to preheat fluid in the reservoir chamber.
2. Unplug the system from the wall outlet. The status line that displays temperature will be flashing BATTERY NO HEATING to indicate the system is now in battery mode, the maximum flow rate is 50 ml/min, and heating is suspended.
3. Adjust the flow rate by pressing INFUSE RATE ▲ or INFUSE RATE ▼ or press 50 ML/MIN to immediately set the infuse rate to the maximum rate of 50 ml/min.
4. When the system is plugged back to the AC outlet, the flow rate stays at 50 ml/min if the previous flow rate was greater than 50 ml/min. The system will return to the previous flow rate if the previous rate was 50 ml/min or lower.
5. The normal running time in battery is at least 30 minutes.

### END OF PROCEDURE

**Before opening the door,  
clamp the patient line closed**

1. Clamp off patient line and bag spikes.
2. Turn circuit breaker to STANDBY.
3. Remove disposable set and dispose in according to the hospital policy.
4. Clean and disinfect the system, see Chapter IV.

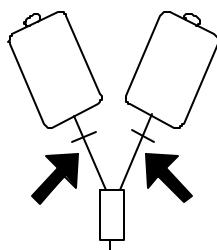
### SCREENS DESCRIPTION

\*\*\*\*\* MISSING DISPOSABLE \*\*\*\*\*  
OPEN DOOR TO SILENCE ALARM.  
INSTALL THE DISPOSABLE.  
CLOSE THE DOOR.

MUTE

Figure 1: Missing disposable set

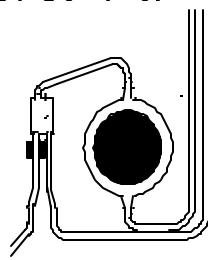
CONNECT FLUID BAGS, UNCLAMP  
LINES AND PRESS PRIME TO BEGIN.



PRIME

Figure 2: PRIME screen

PRIMING THE DISPOSABLE  
AUTOMATIC STOP 100 ml to go



STOP

Figure 3: System priming

#### MISSING DISPOSABLE SET

If you turn power ON without the disposable set, this screen will appear.

1. Open the door or press MUTE to silence the alarm.
2. Install the disposable set as described earlier.

#### PRIME SCREEN

PRIME screen appears after the system finishes the self-check routine.

Press PRIME to prime the main system. The fluid, 100 ml, is sent through the disposable set at 500 ml/min. Priming stops automatically when the countdown reaches 0 ml.

Heating occurs during prime.

#### MAIN SYSTEM PRIMING SCREEN

1. If air is detected during prime, the volume countdown will be reset to 100 ml.
2. If STOP is pressed, the prime volume countdown will remain on screen. To continue prime, press RESUME PRIME.

## II. Operation

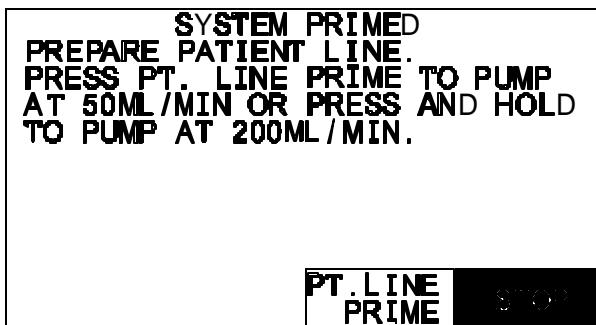


Figure 4: System primed

### MAIN SYSTEM PRIMED & PATIENT LINE PRIME SCREEN

After the main system is primed, this screen appears, ready for the patient line prime.

The patient line must be primed before infusion.

1. Remove the luer cap and make sure that the roller clamp is opened.
2. Press PT. LINE PRIME once to prime at 50 ml/min. Press and hold the key to prime at 200 ml/min.

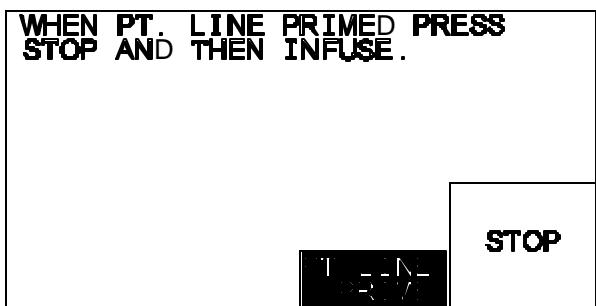


Figure 5: Patient Line Priming

### PATIENT LINE PRIMED SCREEN

Press STOP when the patient line is fully primed.

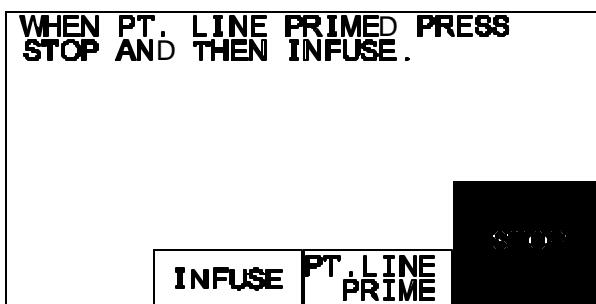


Figure 6: Patient Line Primed

### PATIENT LINE PRIMED & INFUSE SCREEN

After properly priming the system, press INFUSE to go to the main operating screen and start infusion at 10 ml/min.

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RATE= 500 ml min	T= 37.5°C	
VOL= 1301 ml	P= 130 mmHg	
INFUSE RATE ▲ INFUSE RATE ▼	500 ml/min BOLUS 100ml RECIRC	STOP

Figure 7: Infuse Screen

### CAUTION:

The system can infuse fluid at rates up to 750 ml per minute. A unit of blood will be emptied in less than one minute at this rate,

### WARNING:

Excessive or prolonged recirculation may damage red blood cells by exposing them repeatedly to the rollers inside the pump head. Limit the time the blood is allowed to recirculate.

### MAIN OPERATION SCREEN

INFUSE RATE ▲ Press to increase the infusion rate (by 10 ml/min). Press and hold to increase the rate more rapidly. The maximum rate is 750 ml/min.

INFUSE RATE ▼ Press to decrease the infusion rate (by 10 ml/min). Press and hold to decrease the rate more rapidly.

500 ml/min RATE Set the system to infuse at 500 ml/min.

BOLUS The system will infuse the volume indicated on the BOLUS key at a rate of 200 ml/min.

Change the preset bolus volume: press and hold BOLUS key. Release the key when the desired bolus volume appears in the volume delivered position.

Change the infusion rate by using INFUSE RATE ▲, INFUSE RATE ▼ or 500ml/min RATE key.

RECIRC Recirculate fluid, warm, and remove air in the main system at a preset rate of 200 ml/min. Recirculation automatically stops and beeps after 5 minutes.

STOP Temporarily halts pumping and heating. Status display continues to be active.

## II. Operation

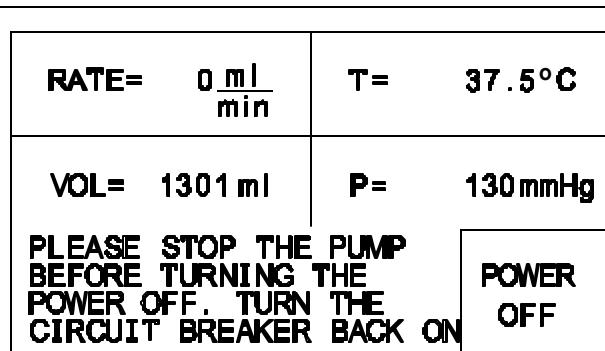


Figure 8: Circuit breaker was turned to STANDBY while pumping

### ACCIDENTAL POWER OFF

If the circuit breaker was turned to the STANDBY position while the system is pumping, the system will stop pumping, alarm and display, Figure 8. This message is to protect the system from being accidentally powered down during a procedure.

To power down the system, press POWER OFF key.

To continue with the procedure, turn the circuit breaker back to the ON position and resume operation.

### CAUTION:

**With fluid in the disposable set and the system not powered on, keep the patient line clamped closed when opening the door to prevent uncontrolled fluid flow.**

### END OF PROCEDURE

1. Clamp off the patient line and bag spikes.
2. Turn the system to STANDBY, using the circuit breaker.
3. Open the door and remove the disposable set from the system. Practice standard hospital policy when handling and disposing the bio-hazardous materials.
4. Follow the cleaning procedures outlined in Chapter IV to clean and disinfect the system.

In the event the system is not operational during a procedure, fluid can be infused manually on an emergency basis using pressure or gravity.

### WARNING!

**In emergency manual operation, all safety features of the system have been bypassed. Monitor the patient line to insure that air is not allowed to enter the patient. Do not apply excessive force on the fluid bag to avoid rupturing the disposable set or damaging blood cells.**

### EMERGENCY MANUAL OPERATION

1. Bypass the system by switching to STANDBY on the circuit breaker.
2. Open the door.
3. Remove the infuse line from the valve wand. The rest of the disposable set may be left intact in the instrument or may be removed. Opening the door will allow the fluid to bypass the roller pump.
4. Apply pressure at the fluid bag to aid flow. Make certain that the bag clamps and patient line are open. Take care that excessive force is not used on the bag to avoid rupturing the disposable set or damaging blood cells.

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RATE= 50 ml/min	BATTERY NO HEATING	
VOL= 1301 ml	P= 130mmHg	
INFUSE RATE ▲	50 ml/min	BOLUS 100ml
INFUSE RATE ▼	RATE	RECIRC

Figure 9. Infuse screen while in battery operation

### BATTERY OPERATION SCREEN

The system can operate in battery mode during transport. The built-in rechargeable battery automatically charges whenever the system is connected to line power. The system automatically switches to battery operation when the AC line is disconnected.

Battery operation should be used only briefly or at very low flow rates because there is no heating.

Full safety monitoring remains active.

The normal running time in battery operation is at least 30 minutes.

### LOW BATTERY

When the battery runs low, the system will display BATT LOW message and sound an audible alarm. The system should be plugged into an AC outlet to continue operation and charge the battery.

The normal recharge time is 8 hours.